Test and Certification Techniques for Autonomous Guidance and Navigation Algorithms for Navy Air Vehicle Missions

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The official link for this solicitation is:
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Description:
Many advanced autonomous guidance and navigation algorithms capable of dynamic route re-planning have been developed. The application of such algorithms to Unmanned Air System (UAS) missions has remained limited. This limited application results from multiple factors; however, the greatest obstacle is airworthiness certification. The development of certification methods for these algorithms remains challenging because of the difficulty in defining test cases and expected results that suitably enumerate the broad range of conditions and non-deterministic responses that may be generated in response to complex environments. The current certification approach relies on brute-force methods to exhaustively test the algorithms making certification efforts prohibitive due to cost and schedule impacts. Therefore, the Navy’s current UAS inventory is limited to fixed, pre-planned mission plans that prohibit fully integrated operations with the fleet. Test and certification techniques for navigation and guidance algorithms specific to Naval missions are needed to integrate higher levels of autonomy into Naval Aviation operations. A wide range of classes of algorithms have seen application in recent UAS autonomous path planning research, such as: potential field methods [1], optimization methods [2], and heuristic search methods [3]. The present inventory of these algorithms is quite large, and the application of each class of algorithm can be quite nuanced. Although some test/demonstration cases have been proposed [4], new, robust analysis, test, and demonstration techniques must be developed to enable the Navy acquisition community to certify systems with autonomous path planning algorithms [5]. PHASE I: Develop and

prove feasibility of initial test and certification techniques for autonomous guidance and navigation algorithms for representative Navy mission scenarios. Mission scenarios could include dynamic path re-planning during shipboard launch/departure and recovery/landing flight phases within the ship’s airspace, including integrated operations with other manned aircraft. The test and certification techniques will be evaluated against accuracy, algorithmic scope coverage, and reduction in test scope from full brute-force style evaluation techniques. PHASE II: Develop a prototype software application/suite for the test and certification techniques and integrate that software with real-time (or faster-than-real-time) software-in-the-loop capabilities that provides a virtual test bed for: (i) assessing the efficacy of various algorithms in different mission scenarios, (ii) developing suitable test/demonstration cases, (iii) robustness of test/demonstration cases across algorithm classes. Develop integration, test, and certification guidelines for the software application/suite to enable testing of future algorithms. PHASE III: Transition a final software application/suite to the Navy (i.e. Triton, Fire Scout, and UCLASS) and other DoD agencies. Additionally, transition the developed technology to commercial UAS industries.